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CONTENTS

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FAO PLANT PROTECTION BULLETIN

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World Reporting Service on Plant Diseases and Pests

Influence of Irrigation and Fertilizer on Populations of Three Species of Mirids Attacking Cotton[1]

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COTTON growers in Missouri and other states of the cotton belt in the United States often express much concern over infestations of three species of mirids; i.e., cotton fleahopper, *Psallus seriatus* (Reut.), rapid plant bug, *Adelphocoris rapidus* (Say) and tarnished plant bug, *Lygus lineolaris* (P. de B.). Each year growers introduce improved production methods in an effort to increase yield. Among the most important of these are irrigation, higher rates of fertilizer, and better insect control. Several workers[2,3] have reported results indicating that populations of the cotton fleahopper and other mirids may be influenced by irrigation or rainfall, and that they are attracted to fields having succulent plants. Due to this phenomenon, more information is needed concerning the influence of plant environment on mirid populations.

Experimental Procedure

A split plot design was used for this study. The experimental plot was divided into two main blocks; one block was irrigated and the other was not. The main blocks were split into plots containing three fertilizer treatments: high, medium, low, and a check which received no fertilizer. The high fertilizer treatment consisted of 100 pounds of N, P, and K per acre turned under prior to planting. The medium treatment consisted of 25 pounds of N, P, and K turned under prior to planting plus an additional 65 pounds of N and 25 pounds of P and K applied as a side dressing on 23 July when the plants were beginning to set bolls. The low fertilizer treatment consisted of 25 pounds of N, P, and K turned under prior to planting. The fertilizer plots were 8 rows wide and 40 feet long. Each treatment was replicated four times within the main blocks.

The irrigation block was irrigated whenever the plants showed signs of stress due to drought. Two inches of water were applied by sprinklers at each of six irrigations (6 June; 6, 17 and 31 July; and 9 and 13 August), or a total of 12 inches of supplemental water during the season. The total rainfall during the growing season at this location is given in Table 1.

TABLE 1. *Rainfall record on fertilizer-irrigation plots at Sikeston, Missouri, 1956.*

Period	Rainfall in inches	Period	Rainfall in inches
May 1–10	0.64	July 1–10	0.08
May 11–20	2.26	July 11–20	1.21
May 21–31	0.32	July 21–31	1.15
June 1–10	0.00	Aug. 1–10	0.79
June 11–20	1.59	Aug. 11–20	1.05
June 21–30	0.43	Aug. 21–31	0.00
		Total	10.24

[1] Contribution from Missouri Agricultural Experiment Station, Journal Series No. 1780. Approved for publication by the Director of the Station.

[2] BUTT, C. H., R. R. WALTON and E. E. IVY. 1946. The cotton fleahopper in Oklahoma. *Okla. Agr. Exp. Sta. Tech. Bull.* T 24.

[3] GAINES, J. C. 1933. A study of the cotton fleahopper with special reference to the spring emergence, dispersal and population. *Jour. Econ. Ent. 26*: 963-971.

The plots were planted to Coker 100 W on 11 May 1956. The soil was of a very sandy type of low water-holding capacity. No insecticide treatments were applied to the plots.

All data were taken from the two center rows of each plot. Beginning 7 July, counts were made at weekly intervals of the number of cotton fleahoppers, rapid plant bugs, and tarnished plant bugs present in the plant terminals. The counts were made from terminals of 20 plants selected at random in each plot. The cotton fleahopper was the predominant species, but for purposes of this study the counts were lumped together.

Methods of analysis of variance were used for determining significant differences in the populations resulting from various treatments.

Results and Discussion

From the results given in Table 2, it can be immediately noted that there were no significant differences in the insect populations present among the various plots until 1 August. Drought symptoms became very noticeable in the nonirrigated block at that time. From this date, the differences in plant appearance among the various fertilizer treatments in the nonirrigated block became progressively less distinct.

Gaines [4] and Butt *et al* [4] reported that the cotton fleahopper and other mirids were attracted to succulent cotton and migrated from maturing cotton to succulent cotton. Thus, the physiological activity of the plant evidently has some influence on the numbers of mirids present. During most of July plants in all plots were succulent and did not seem to be suffering from drought. However, there were marked differences in height, color, and amount of foliage among plants in the various fertilizer treatments in both blocks. These differences in plant appearance were evidently due, in most part, to the rates of fertilizer and, to a much lesser

[4] *Loc. cit.*

TABLE 2. *Influence of fertilizers and irrigation on mirid populations, Sikeston, Missouri, 1956.*

Date of observation	Number mirids on 80 plants							
	High fertilizers		Medium fertilizers		Low fertilizers		No fertilizers	
	irrigated	non-irrigated	irrigated	non-irrigated	irrigated	non-irrigated	irrigated	non-irrigated
July 18	11	5	8	5	4	5	5	7
25	14	7	9	8	14	11	20	12
Aug. 1	52	16	26	4	17	13	20	19
8	33	7	18	1	11	4	29	9
15	31	4	44	1	14	0	20	0
22[a]	22	—	18	—	0	—	3	—
29	20	—	8	—	0	—	2	—
Total. . .	183	39	131	19	60	33	99	47
Average .	26.1	7.8	18.7	3.8	8.6	6.6	14.1	9.4

[a] Counts discontinued in nonirrigated plots on 22 August as the plants were profoundly drought-stricken and had neither terminal buds nor squares.

degree, to differences in soil moisture between the irrigated and nonirrigated blocks. During this period, the plants in the irrigated high and medium fertilizer treatments were the tallest and had a more luxuriant growth than did the plants in the other plots. The plants which received no fertilizer in the nonirrigated block were the smallest and showed less vegetative growth.

By the end of July the differences in plant appearance due to soil moisture became evident. The plants in the irrigated block were succulent and those in the nonirrigated block drought-stricken. The plants in the nonirrigated blok had begun to shed squares and bolls heavily by 8 August. By mid-August there were neither terminal buds nor squares present on these plants and all the fruit except the larger bolls had been shed. From this date there were no apparent differences in the vegetative appearance among the plants in the various fertilizer treatments of this block. During this period in the irrigated block, the differences in plant appearance among the fertilizer plots became increasingly evident throughout the remainder of the season.

During July, when symptoms of drought were not evident, there were no significant differences in the numbers of insects present among the treatments. Toward the last of July the populations began to increase in all plots. The first significant differences in the numbers of insects present among the treatments were found on 1 August. The highest numbers were found in irrigated plots with high fertility treatments. There was little difference in the number of insects counted among the various fertilizer treatments in the nonirrigated block. The differences in populations among the treatments were due to both fertilizer and irrigation and were statistically significant at the 1 percent level of probability. It was interesting to note the influence of the higher levels of fertility on the mirid populations as reflected by the small difference in the number of insects found between the low fertility and check plots in both the irrigated and nonirrigated blocks. The differences in populations at this date coincide with the first symptoms of drought and indicated the influence of irrigation.

The differences in mirid population at the 8 August count were due to both irrigation and fertilizer and were statistically significant at the 5 percent level of probability. By 15 August, the differences in insect populations due to fertilizer rates were not significant. The differences in insect numbers due to irrigation were highly significant. All counts after 15 August were made only in the irrigated block as the plants in the nonirrigated block were so drought-stricken that no mirids were present.

The analysis of variance for the total number of insects found among the plots over all counts indicated that there were statistical differences in the seasonal populations at the 1 percent level of probability as a result of both irrigation and fertilizer rates. The interaction between fertilizer and irrigation was not significant at any time during the season. Over the season, the greatest number of mirids were found in the irrigated, high fertility treatment and the lowest number in the nonirrigated, medium fertility treatment.

As the symptoms of drought became more pronounced, the influence of fertilizer on plants and insect populations became less apparent and that of irrigation more evident. This apparently was the result of the drought on the nonirrigated block, which tended to obliterate the influence of the various fertilizer rates on plant growth. Thus, the influence of various fertilizer rates on mirid populations appears to be a result of their effect on plant growth. This influence may be very pronounced under certain circumstances, such as periods of ample rainfall or irrigation, wich create optimum conditions for the efficient utilization of fertilizer by the plant. The end result is the production of increased vegetation and succulent growth, which is very attractive to mirids. In other circumstances, such as under conditions of extreme drought, the plants may become inefficient in their utilization of fertilizer and may not produce the rank, succulent growth that is attractive to mirids. Evidence of this was indicated by the small difference in numbers of insects found in the high and low fertilizer treatments in the nonirrigated block. Also, in nearly all cases there were more insects present in the irrigated fertilizer treatments than there were in their nonirrigated counterparts.

TABLE 3. *Influence of fertilizer and irrigation on cotton yield, Sikeston, Missouri, 1956.*

Picking	Yield of seed cotton per acre in pounds							
	High fertilizers		Medium fertilizers		Low fertilizers		No fertilizers	
	irrigated	non-irrigated	irrigated	non-irrigated	irrigated	non-irrigated	irrigated	non-irrigated
First	112.2	396.8	430.4	593.6	432.5	553.9	86.7	172.4
Second	1580.0	495.7	1619.8	393.7	1083.2	445.7	531.4	532.4
Third	513.1	—	284.6	—	127.5	—	202.0	—
Total	2205.3	892.5	2334.8	987.3	1643.2	999.6	820.1	704.8

It was interesting to note that at every count the check plots receiving no fertilizer had higher populations of mirids than did the plots receiving the lowest fertilizer rate. This indicates that low fertilizer rates have little influence on mirid populations and that it is the higher rates, combined with ample moisture, which produce rank, vigorous, succulent growth which attracts mirids. It will be noticed by the yield data in Table 3 that this so-called low fertilizer rate was ample under irrigation to increase the yield approximately twice that of the check.

Although no insect control was practiced, the yields in the fertilized, irrigated plots were considered to be good for this soil type. There is no doubt that mirids may, under certain conditions, greatly reduce yields. However, the yield data from this experiment indicated that in some instances, comparatively high infestations may cause little, if any, reduction in yield.

Summary

A split plot design was used for this study, combining irrigation with several fertilizer rates, in order to study their influence on mirid populations.

There were no significant differences in the insect counts among the plots until drought symptoms became evident. Then, the highly fertilized, irrigated plots were infested with the greatest number of mirids. The smallest number of mirids were found in the nonirrigated plots getting small amounts of fertilizer.

In nearly all cases, there were more insects present in the irrigated fertilizer treatments than there were in their nonirrigated counterparts. The differences in populations among the treatments were due to both fertilizer and irrigation.

Although no insect control was practiced, the yields were considered to be good in the fertilized irrigated plots.

Virus Dieback of Sweet Cherry in Verona, Italy

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Virus dieback of sweet cherry (*Prunus avium*) in Verona province of northeastern Italy is an old disease which has spread continuously and is now affecting quite a large number of trees. Thousands of sweet cherry trees are dead or become unproductive due to the disease. Statistics show that cherry production in Verona province has decreased to about 40 percent of the average figure of some years ago.

The disease is most widespread in the Valpolicella district, affecting particularly the trees of "Mora di Cazzano" variety, both young and old, with a remarkable variety of symptoms.

Symptoms

The first symptoms of the virus dieback usually appear only on a part of the foliage of the tree and then spread to all the leaves, resulting in the death of the tree in three to six years. In orchards, the spread

Figure 1. Sweet cherry tree of variety Mora di Cazzano, infected by virus dieback.

of the disease is particularly evident on trees near the diseased ones.

The symptoms observed on trees of the Mora di Cazzano variety appear to progress in the following sequence. In the first year, oily spots appear on leaves and phloem necrosis becomes evident. During the second and third years, the general symptoms include the curling and the progressive yellowing of leaves with edges turning red. Deformed leaves, which are coriaceous, smaller than normal ones and serrated, are found on affected trees along with normal leaves, and they often form rosettes in tufts of six to eight. The diseased trees blossom profusely but many flowers fall, producing much less fruit than a normal tree. Dieback of the tree begins at this stage (Figure 1) and progresses during the following years until the tree is dead.

Numerous oily spots and deformed leaves have also been observed on seedlings of the Mazzard cherry (*Prunus avium*) used as rootstocks in this area, but not the other symptoms of the disease. Young trees of Mahaleb cherry (*Prunus mahaleb*) used also as rootstocks of sweet cherry, however, are completely free from any indication of infection.

Etiology

A study of the disease was initiated in 1953. It was suspected at first that it was due to nutrient deficiency, because some of its symptoms appeared similar to those characteristic of the nutritional phloem-necrosis of peach, which was under investigation in the same province during the same period. In the following three years, different mineral and organic manures were tried under various experimental conditions. The results, however, were invariably negative.

In August 1956 an experiment was undertaken to explore the possibility of transmitting the disease by budding and grafting. Oriental flowering cherry (*Prunus serrulata*) variety Shirofugen, sweet cherry varieties Bing, Lambert, and Napoleon and Mazzard F 12/1 (clone E. M.) were used as indicators. Preliminary results obtained from this experiment after one year establish the virus as the cause of this disease.

On the ground of the similarity of symptoms, it is possible that the virus dieback of sweet cherry in Verona province may belong to the group of the virus diseases known in Switzerland under the name of Pfeffinger disease. The differences of symptoms which have been noticed between these two diseases are not greater than those reported for the Pfeffinger disease itself from various parts of Switzerland. Similar virus diseases have also been reported from France, Germany, the Netherlands and England, under such names as Eckelraden disease and cherry rasp leaf.

Since the identity between the Pfeffinger disease and the disease of Verona is not yet certain, it seems appropriate to distinguish the Verona disease with the name of virus dieback. As it is assumed in the case of Pfeffinger disease, the virus dieback seems to be due to a virus complex, some components of which appear to be transmissible through seed.

Efforts have not yet been made to compare the virus dieback of Verona with other diseases causing dieback of sweet cherry trees, reported previously from other provinces in Italy. However, it may be assumed that the geographic distribution of virus dieback covers some provinces other than Verona.

Recent Outbreaks of Maize Rust in the Philippines

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THE first rust on maize recognized in the Philippines was caused by *Puccinia sorghi* Schw. As previously reported, [1] this disease has never been found to cause any appreciable damage and its outbreaks were so mild that practically no attention was paid to it. Its earliest incidence was reported in the Mountain Province in northern Luzon on sweet corn, the seed of which was believed to originate from California.

During the last few years, epidemic outbreaks of a rust different from *Puccinia sorghi* were repeatedly observed on maize in various parts of the Philippines. The earliest notable outbreak occurred in 1948 in Leyte and Samar and subsequently in Cebu. Later, serious outbreaks in other parts of the Philippines were revealed by the maize disease survey conducted by N. I. Roperos and P. C. Tobias of the Bureau of Plant Industry during early and mid-1956, covering the maize-growing areas of Cagayan and Isabella, and some parts of Nueva Ecija, Pampanga, Bataan, Laguna and Batangas. From February to August of that year, the same disease was noticed on maize leaves collected by the writer in various parts of Mindanao, particularly in the Province of Cotabato. In January 1957, this disease was again reported to be serious in Leyte, Samar and Cebu and possibly all the Visayan Islands where maize is grown as a staple crop.

Field observations indicate that the development and spread of the disease have been greatly favored by the prevalence of moderately high temperature, the presence of free moisture on leaf surface, succulent plant growth and the existence of abundant inoculum due to the continuous planting of susceptible varieties. Where the disease is widespread, dissemination is facilitated by prevailing strong winds. Severe infection weakens the plants and lowers the yield and quality of the crop, but the disease has never been found to be fatal even though some affected plants were defoliated or failed to produce ears.

Using seeds collected from heavily infested plants in Leyte and Samar, where this newly found rust species is suspected to originate, and from Cotabato and Misamis Oriental, the disease was reproduced in Manila but it was never as serious as that occurring at the places of origin.

Leaf symptoms produced by the newly introduced species of maize rust resemble in many respects those of the common maize rust (*Puccinia sorghi*) and, the two species are easily confused in the field. Closer examination, however, would show that the pustules of the new and more virulent species are generally smaller but more numerous than those of the common maize rust. The pustules, like those of *P. sorghi*, are conspicuously elevated on the upper surface of the leaf, but remain intact for a longer period before fissures are produced to permit the dissemination of mature spores. Pustules are also produced sparingly on ears, husks and tassels.

The uredospores of the new rust fungus are orange, mostly globoid to ellipsoid but some are angular or irregular and sparsely echinulated. Based on the characteristic symptoms of the disease, the fungus was referred to as *Puccinia polysora* Underw. In December 1956, dried specimens of this maize rust from different provinces of the country were sent to the Commonwealth Mycological Institute for determination and its identity with *P. polysora* was confirmed. Dr. G. P. Ocfemia of the College of Agriculture informed the writer in January 1957 that the new maize rust found in the Los Baños area was identified also as *P. polysora* by the Plant Industry Station of the U.S.

[1] REYES, G. M. 1924. On the occurrence of maize rust in the Philippines. *Philippine Agr. Rev. 17*: 3-9.

3. f. 716

Department of Agriculture. A similar leaf rust has been observed on nutgrass (*Cyperus rotundus*), which grows abundantly in many maize fields.

A parasitic fungus, *Darluca filum* (Biv.) Cast., was found in association with *Puccinia polysora* as well as with *P. sorghi*. Its spores are fusiform, hyaline, two-celled with a nonconstricted transverse septum. Tiny orange insect larvae were almost invariably found feeding on the spores.

Before 1949, *Puccinia polysora* was known to occur only in America. After its invasion into Africa, it spread rapidly across the continent and in several years had reached islands in the Indian Ocean and eventually found its way into South-East Asia. In addition to the Philippines, this rust has been found in Malaya, Thailand and India.

In the Philippines, the sudden appearance of this new disease in a number of distant areas where maize is an important food crop, has caused much alarm to farmers and governmental agencies. Since no other effective methods for controlling this disease is known, the Bureau of Plant Industry and the College of Agriculture are presently engaged in the development of maize varieties resistant to this disease through selection and breeding. So far no commercial varieties of maize have been found to be resistant, but inbred lines as well as F_1 hybrids are being tested in infested areas to determine their reactions to *Puccinia polysora*.

In the meantime, the following preventive and field sanitation measures are recommended to maize growers:

(1) Burning of all infected materials immediately after harvest.
(2) Practice of clean cultivation to eliminate possible secondary hosts.
(3) Use of sprays, such as Dithane Z-78, Gy-Cop 53 and Bordeaux mixture, two or three times before infection begins, to protect the plants. Lime sulphur spray is also being tried for this purpose.
(4) As an additional precaution, growers are urged to use seed only from plants which have been found free from visible infection, especially in areas where the disease has not become widespread or prevalent.

Septoria Spots of Citrus in Greece

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CITRUS fruit is often damaged by different species of *Septoria*, among which *S. citri*, *S. limonum*, *S. citricola* and *S. depressa* are the ones most frequently encountered. In Greece, the only species of *Septoria* previously known to occur on citrus is *S. citri*, which has been reported (8) since 1939 on orange and mandarin trees from the mainland and islands.

In late winter of 1955/56, another species, *Septoria depressa*, was found on numerous samples of lemons originating from various areas, with lesions covering the whole fruit or a great part of it. The infection greatly reduced the marketing value of the fruit, particularly because it was destined for exportation. Heavy damage caused by this fungus was also reported in citrus orchards on the northern coast of the Peloponnese peninsula, as well as on the coast of Poros Island. As this was the first time *S. depressa* was found in Greece, and because of the serious losses it caused, studies were undertaken to determine its biological characteristics and control measures.

Symptoms and Causal Fungus

The fungus causes deep angular spots on lemons, 0.5 to 4 millimeters long, which often coalesce to cover a large part of the fruit (Figure 1). The spots are of a rusty color on green lemons but become darker when the fruit turns yellow.

The fungus was identified as *Septoria depressa* because the measurements of Pycnidia and spores fit well with the description of this species. The ostiolate pycnidia measure 56-207 μ in diameter, with an average of 105 μ. The spores are hyaline, cylindrical, 0-2 septate, straight or somewhat curved, 10-23 × 1.4-4 μ averaging 16 × 2.9 μ.

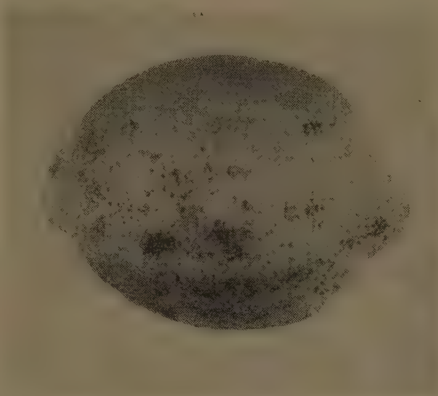

Figure 1. Infection of *Septoria depressa* on lemon.

Climatic Factors and Disease Development

Klotz and Fawcett (5) stated that rains or dews in the late summer, early autumn, or late spring as well as low, rapidly fluctuating temperatures, were believed to favor the development of Septoria spots. In New South Wales of Australia, it was recorded (1, 2) that the development of infection by *Septoria depressa* was associated with continuous wet weather and a certain amount of frosting.

Similar meteorological factors obviously determine the extent of infection by *Septoria depressa* in Greece. During 1956 the infection began to appear in January and continued until the end of February. During that period, there were nine rainy days in January with a total rainfall of 57 millimeters, and ten rainy days in February with a total rainfall of 142 millimeters. There were

also abrupt daily fluctuations in temperatures, creating warm and cold periods alternatively. The maximum and minimum daily temperatures during that period fluctuated from 4° to 20° C. and from 1° to 12° C. respectively.

In the laboratory, where the effect of temperature on the development of the fungus was tested by the use of Petri dish cultures, the optimum temperature for growth was found to be 20° C. The fungus ceased to grow at 35° C. but developed fairly well at temperatures lower than 20° C. This may explain the fact that the disease occurs only in the winter months.

Wind apparently plays an important role in the transmission of spores and in the wide distribution of the disease. During January and February 1956, when the disease was prevalent, northern winds were prevailing and it was observed that a large number of spots was produced on the side of fruit exposed to the north, whereas the opposite side was free of infection or had only very few spots.

Control Measures

Measures for controlling Septoria spots of citrus have been studied in Australia (1) and the United States (3, 4, 5, 6, 7). Copper and zinc fungicides, applied in the autumn before the first rains, have been recommended for prevention of the disease.

In Greece, it is recommended to apply two to three sprays containing zinc sulphate, copper sulphate and hydrated lime in the proportion of 500, 100 and 400 grams per 100 kilograms of water. The first spray is to be applied in early autumn and the second in early winter, in order to prevent both the brown rot caused by *Phytophthora* and the Septoria spot. A third spray in winter would be desirable if the weather conditions were favorable to the development of Septoria spot.

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Outbreaks and New Records

Canada

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Highlights of Insect Occurrences, 1957

A major factor affecting insect abundance and damage in Canada in 1957 was the unusual variation in rainfall. In Manitoba, heavy rains greatly reduced grasshopper abundance and in Saskatchewan, fine weather at hatching favored unexpectedly large numbers. After the heavy rains associated with the hurricane at the end of June in the east, there were drought conditions in many regions of both east and west. Probably associated with these weather conditions were large populations of aphids from coast to coast, notably on trees in the west, and unusual injury by the six-spotted leafhopper (*Macrosteles divisus*), the red-backed cutworm (*Euxoa ochrogaster*), and white grubs.

In the interior of British Columbia, grasshoppers were slightly more numerous than in 1956 and control measures were necessary in the Okanagan and Thompson valleys, where fruit and vegetables were attacked. They caused little damage in Alberta, but in south-central and extreme southern agricultural regions of Saskatchewan an unexpected increase caused moderate losses, especially in flax. In southern Manitoba, although heavy rains checked hatching and favored development of disease organisms and lush plant growth, sufficient numbers survived to cause extensive damage in gardens, field margins, pastures and meadows.

As usual, cutworms were generally injurious, but an outbreak of the red-backed cutworm from British Columbia to Saskatchewan was the worst in several years. In the interior of British Columbia this pest attacked vegetable and flower gardens, alfalfa and grain. In Alberta and Saskatchewan, local losses in grain ranged from 50 to 100 percent. Severe damage in foothills and parkland was a new feature for the species. A moderate outbreak of the army cutworm (*Chorizagrotis auxiliaris*) occurred in southern Alberta, but larvae developed early and much damage was averted by delayed seeding. In eastern Canada the armyworm (*Cirphis unipuncta*) damaged grain, hay, maize and pastures in every province, severe local outbreaks occurring in southwestern Ontario, Quebec, New Brunswick and Newfoundland.

A very severe infestation of second-year white grubs occurred in all agricultural areas of Ontario except the Niagara Peninsula and extended into southern Quebec and New Brunswick. Damage to all host crops was severe and in eastern Ontario this was accentuated by drought. Skunks fed extensively on the grubs, causing further damage to permanent sod.

A general outbreak of the six-spotted leafhopper caused severe damage to flax, carrots, beets, lettuce, maize, potatoes and celery in the Prairie Provinces and Ontario. Local outbreaks of the beet webworm (*Loxostege sticticalis*) damaged rape and flax in Alberta and Saskatchewan, the infestation in the latter province being the heaviest in several years. The "painted lady" (*Vanessa cardui*) was unusually numerous from Manitoba to Nova Scotia, the damage in Manitoba being extensive in sunflowers and sugar beets. Unusually large numbers of the zebra caterpillar (*Ceramica picta*) fed on various hosts in Ontario. Sod webworms (*Crambus* spp.) heavily infested grassland in the Fraser River Valley, British Columbia, and pastures in Prince Edward Island. The pea aphid (*Macrosiphum pisi*) was very injurious to alfalfa on irrigated land in Alberta. Damage by wireworms and root maggots was gener-

ally much lighter than usual, partly because of improved control measures.

Some pests also caused notable injury to vegetables. The alfalfa looper (*Autographia californica*) severely damaged lettuce at Cloverdale, British Columbia. Aphid populations on potato in New Brunwick were the largest in several years. The area infested by the carrot weevil (*Listronotus oregonensis*) in the Holland Marsh, Ontario, increased from 150 acres in 1956 to 300 acres in 1957. An unusual infestation of the Colorado potato beetle (*Leptinotarsa decemlineata*) on 10 acres of tomatoes in Kent County, Ontario, required control measures. Populations of the potato leafhopper (*Empoasca fabae*) on potatoes, beans and alfalfa were the largest in several years in southwestern Ontario. The potato stem borer (*Hydroecia micacea*) was unusually abundant in maize, tomatoes, potatoes and rhubarb in eastern Canada. The squash vine borer (*Melittia cucurbitae*) was very numerous in southwestern Ontario. Slugs were very injurious to maize, timothy and vegetables in Ontario, after heavy rains associated with the hurricane. Nematodes were recorded for the first time as pests in market gardens in irrigated areas of Alberta and on onions in southern Ontario.

Damage by fruit insects was highlighted in British Columbia by a heavy infestation of various soft scales on apricots and peaches in the Okanagan Valley and an unprecedented infestation of cane fruits by the raspberry cane maggot (*Pegomya rubivora*) in coastal areas. In Ontario, parasitism of the Oriental fruit moth (*Grapholitha molesta*) by *Macrocentrus ancylivorus* Rohw. was unusually high; the grapevine aphid (*Aphis illinoisensis*) heavily infested grape in Lincoln County, after extreme scarcity for 30 years; and an aphid appearing on apple in recent years was identified as *Ovatus* sp. near *crataegarius* Wlkr. Insects recorded as pests of strawberry for the first time included lepidopterous larvae in stems and fruit in coastal British Columbia, *Harpalus rufipes* DeG. feeding extensively on fruit at Medford, Nova Scotia, and *Cnephasia virgaureana* Tr. infesting plants in Newfoundland.

Other newsworthy items included first records of the lilac leaf miner (*Gracilaria syringella*) at Lethbridge, Alberta, of the spider beetle *Ptimus raptor* Sturm in Saskatchewan and of *Musca autumnalis* DeG. in Quebec.

Pakistan

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Insect Parasites of Desert Locust

In order to raise a sufficient stock of desert locust (*Schistocera gregaria*) for research work during the present regression period, living locusts were collected regularly from the field from September 1955 onward. The specimens were caged for rearing and mass multiplication under laboratory conditions. The dead locusts were removed daily from the cages and kept under observation in sterilized cotton-plugged glass tubes for the emergence of insect parasites. A few mature Calliphorid larvae emerged from several females collected from the environs of Karachi. Adults that developed from these larvae were identified as *Wohlfahrtia erythocera* Villen.

Similarly, from desert locusts collected from Bahawalpur and D. I. Khan, West Pakistan, two parasites emerged which were identified as *Sarcophaga dux* Thom., (Calliphoridae), and *Megaselia* sp. (Phoridae). These two species were released on living locust to study their parasitic potential but the trials have not progressed beyond their preliminary stage.

Previous records and literature reviewed seem to indicate that these are first records for the Indo-Pakistan subcontinent.

The identification of the parasites was confirmed by the Commonwealth Institute of Entomology, and the work was facilitated by the Food and Agriculture Council of Pakistan. The writers wish to express their gratitude to both of these bodies.

Plant Quarantine Announcements

India

Notifications No. 6-10/53-Dte. 1 and No. 6-10/53-Dte. 5, both dated 13 June 1957, were issued by the Department of Agriculture and published in the *Gazette of India* No. 25 on 22 June 1957, for regulating the importation of plants by air.

1. Notification No. 6-10/53-Dte. 1 supersedes Notifications No. F. 6-33/50-Dte. 1 of 6 May 1954, No. F. 6-6/54-Dte. 1 (PPS) of 27 July 1954 and No. F. 6-6/54-Dte. 1 of 4 August 1954, and amends Notification No. F. 320/35/A with regard to the importation of plants by air. The amendment provides that plants others than those species whose importation is prohibited or specifically restricted may be imported by air through the airport at Bombay, Madras, Calcutta or New Delhi, if accompanied by a special permit issued by the Plant Protection Adviser to the Government of India and by an official phytosanitary certificate of the country of origin in the form of that annexed to the International Plant Protection Convention of 1951. The plants must be inspected and, if necessary, treated upon arrival. The importer must furnish to the Collector of Customs at least 15 days in advance of the date of arrival particulars of the consignment.

For plants imported by any governmental research institutions, the special permit of the Plant Protection Adviser is not required. The import from Afghanistan of fruits and vegetables intended for consumption may be permitted after fumigation at the airport at Amritsar at the expense of the importer.

Requirements for import by air of plants infested with living insects for the purpose of introducing such insects, as provided in Notification No. F. 320/35/A, remain the same.

2. Notification No. 6-10/53-Dte. 5 prescribes the application form for a permit to import plants by air and the form of the permit, and provides detailed procedures required for the importation of plants by air.

New Zealand

Forest Produce Import and Export Regulations of 17 September 1956 were published in the *New Zealand Gazette* on 20 September 1956. The term " forest produce " refers to timber, timber produce, the produce of trees and dunnage, but does not include any living tree or plant or any part thereof or any tree seed.

Importation

All forest produce destined for importation must be inspected upon arrival by a quarantine officer. If they are found to be free of organisms that might be injurious to forest produce, they may be removed after obtaining a certificate signed by the officer. In case they are found infested with injurious organisms they will be deposited in a quarantine ground for observation, or treated according to the quarantine officer's direction, or reshipped or destroyed.

Exportation

Forest produce may not be exported before it has been inspected by a quarantine officer and a certificate in prescribed form has been issued. The produce must be free from bark and from injurious organisms or it must have been treated to eliminate the danger of introducing injurious organisms into any other country.

Exotic timber for export to the Island Territories of New Zealand should be treated with a preservative or, if intended for temporary use, dried to a moisture content not more than 22 percent of its oven-dried weight.

Exotic timber for export to places other than the Island Territories of New Zealand must be dipped immediately after sawing in an antisapstain solution if exported in a green condition, or dried to a moisture content not exceeding 22 percent.

Union of South Africa

The Agricultural Pest Act, 1957, published in the *Government Gazette*, Vol. 189, No. 5887, 14 June 1957, consolidates the laws relating to the prevention of the introduction into and spread within the Union of insect pests, plant diseases and bee diseases and the regulation of the importation of exotic animals. It repeals the Agricultural Pests Act, 1911 (as amended in 1922, 1924, 1933 and 1934), Agricultural Pests (Citrus Canker) Act, 1919 and Proclamations No. 116 of 1927, No. 151 of 1937, No. 93 of 1956, insofar as they concern the listing of plants whose importation is prohibited (see *FAO Plant Prot. Bull. 4* : 190. 1956), and No. 145 of 1956 (see *FAO Plant Prot. Bull. 5* : 31. 1956). The following provisions govern the importation of plants.

Imports Prohibited

The introduction from overseas of the following plants is prohibited:

1. eucalyptus, acacia or coniferous plants;
2. peach stones;
3. seeds and flowering or seed heads of any species of *Arctium*;
4. fresh stone fruits, i.e. apricots, plums, peaches, nectarines and cherries;
5. any species of *Opuntia*;
6. lucerne hay, whether fresh or dried;
7. *Hibiscus esculentus*;
8. *Hibiscus cannabinus*, excluding retted or decorticated kenaf fibre;
9. any cotton plant or wild cotton plant of the genus *Gossypium* or *Thurberia* on any other plant of the genus *Bauhinia*.

Import Permits Required

Importation of any plant from overseas requires a written permit of the Department of Agriculture, specially authorizing the introduction of that plant. For this purpose, fruit, bulbs, tubers, vegetables, portions of plants which cannot be propagated, and herbaceous plants will be regarded as plants only when so declared by the Minister of Agriculture. The permit may limit the number of plants to be introduced to a maximum of 10 rooted plants or 100 cuttings of one variety.

Imports Specifically Restricted

The plants mentioned below may be imported only if the introduction is supervised by an officer of the Department of Agriculture and a permit has been obtained.

1. grape vines or other plants of the family Vitaceae;
2. sugar canes;
3. plants cultivated for the production of rubber;
4. tea plants;
5. cotton seeds;
6. lucerne seed;
7. lucerne plants or any portion thereof;
8. any seed of tobacco or of any plant of the genus *Nicotiana*.

Points of Entry

Plants may not be introduced except by post or through the port of Cape Town, Durban, East London or Port Elizabeth, or through any other port proclaimed by the Governor-General.

Inspection and Treatment

Any plant introduced from overseas together with its covering or packing material may be examined by an officer of the Department of Agriculture. If found infected, the officer may direct that the plant and its packing be cleansed, desinfected or otherwise treated or destroyed.

Imports from African Territories

The Governor-General may declare that any of the provisions mentioned above relative to plants from overseas, shall apply to plants introduced from parts of South Africa outside the Union.

United States

1. Administrative instructions for cold treatment of imported *vinifera* grapes and certain other fruits was amended by a Foreign Quarantine Notice published in the *Federal Register*, Vol. 22, No. 130, 6 July 1957. The amendment changes the refrigeration requirements applicable to imported fruit because of the Mexican fruit fly (*Anastrepha ludens*), which has been found to be more resistant to low temperatures than other species of *Anastrepha*. Fruit cold treated should be refrigerated at or below the respective temperature designated for the indicated period for various species of fruit fly.

Mediterranean fruit fly
- 10 days – 32° F.
- 11 days – 33° F.
- 12 days – 34° F.
- 14 days – 35° F.
- 16 days – 36° F.

Anastrepha spp. others than *A. ludens*
- 11 days – 32° F.
- 13 days – 33° F.
- 15 days – 34° F.
- 17 days – 35° F.

Mexican fruit fly
- 18 days – 33° F.
- 20 days – 34° F.
- 22 days – 35° F.

2. Administrative Instructions authorizing the importation of frozen fruits and vegetables was amended by a Foreign Quarantine Notice published in the *Federal Register*, Vol. 22, No. 162, 21 August 1957. The primary purpose of the amendment is to provide a specific degree of coldness, 20° F., to which the temperature of fruits and vegetables must be lowered before they may be unloaded.

The treatment required involves an initial quick freezing at subzero temperatures with subsequent storage and transportation handling at not higher than 20° F. Such frozen fruit and vegetables may be imported from any country under permit at such ports as authorized in the permits.

The importation of frozen fruit and vegetables from countries where they are subject to attacks of pests that may not be destroyed by freezing is not authorized.

News and Notes

WHO Conference on Insect Resistance

A Technical Conference on Insect Resistance to Consider an International Collaborative Program of Research was convened by WHO in Geneva, 25-31 July 1957. Although the Technical Conference was concerned mainly with insects of public health importance, the problem should be of equal interest to entomologists dealing with insect pests of plants.

To illustrate the alarming growth of the resistance problem, the Technical Conference cited that the number of resistant insect species of public health importance has been steadily increased from 2 in 1946 to 38 in 1956. The geographic area involved and the number and type of insecticides to which insects have become resistant have also increased from year to year. The problem in growing in complexity and magnitude more rapidly than progress is being made in its elucidation. While some advances have been made in the understanding of the problem, not a single practical solution has been forthcoming, except switching from one insecticide to another. Present research efforts are not only inadequate in all countries but too much has been concentrated on too few aspects of the problem through lack of co-ordination. An international program of collaborative research is therefore urgently needed.

Since a continuous appreciation of the resistance problem depends primarily on the rapid detection and reporting of the development of resistance in the field, the Technical Conference emphasized the need for a sufficient number of field laboratories to determine immediately the susceptibility levels of all important vectors in various areas and to test countermeasures under local conditions. Basic research which does not necessarily relate to field problems is to be carried out by larger centralized laboratories.

The Technical Conference classified research into the resistance problem as follows:

(1) Identification of the resistance mechanism and other biological and physiological factors associated with resistance. Four types of resistance mechanisms were recorded:

- (i) insect does not come into contact with insecticide through abnormal behavior;
- (ii) insect does not absorb or ingest insecticide;
- (iii) insect detoxifies or excretes insecticide; and
- (iv) the nerve axon of the insect is protected through abnormal myoneural mechanism.

(2) Study of the ecological and genetic factors in the development, sustainment and regression of resistance.

(3) Countermeasures based on the above.

Roma - Tip. del Senato del dott. Giovanni Bardi

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